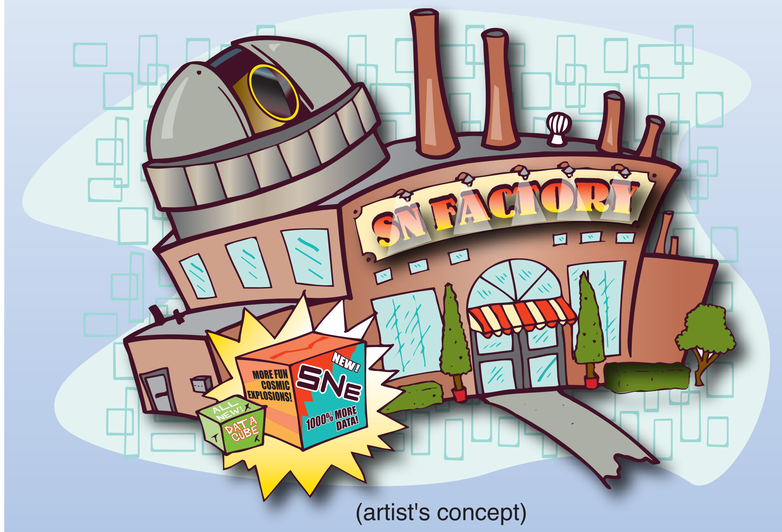
The Nearby Supernova Factory

R. Scalzo, G. Aldering, B. C. Lee, S. Loken, P. Nugent, S. Perlmutter, J. Siegrist, R.C. Thomas, L. Wang, W. M. Wood-Vasey (Lawrence Berkeley National Lab),
G. Adam, R. Bacon, C. Bonnaud, L. Capoani, D. Dubet, F. Henault, B. Lantz, J.-P. Lemonnier, A. Pecontal, E. Pecontal (Centre de Recherche Astronomique de Lyon),
N. Blanc, G. Boudoul, S. Bongard, A. Castera, Y. Copin, E. Gangler, G. Smadja (Institut de Physique Nucleaire de Lyon),
R. Kessler (Kavli Institute for Cosmological Physics, University of Chicago), P. Antilogus, P. Astier, E. Berrelet, G. Garavini,
S. Gilles, L.-A. Guevara, D. Imbault, C. Juramy, R. Pain, R. Taillet, D. Vincent (Laboratoire de Physique Nucleaire et de Haute Energies de Paris),
C. Baltay, A. Bauer, D. Rabinovitz (Yale University)

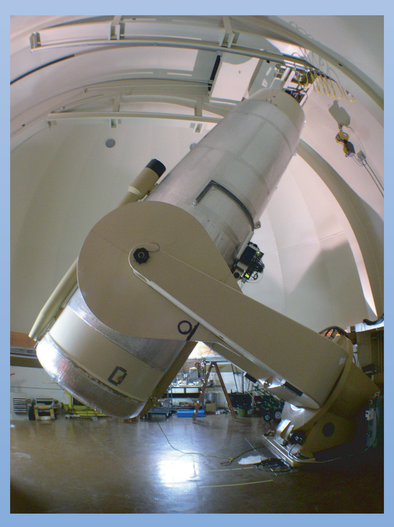


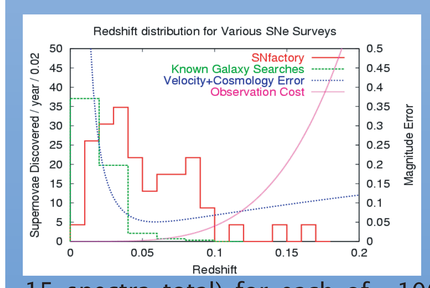
(artist's concept)

The Nearby Supernova Factory (SNfactory) is a project to discover, and study in detail, approximately 300 type Ia supernovae (SNe Ia) in the redshift range $0.03 < z < 0.08$. Supernova candidates are found by searching wide-field imaging data from the Near Earth Asteroid Tracking (NEAT) project at JPL, and from the Palomar Consortium (Yale/JPL/Caltech); this ultimately produces a sample of supernovae which is unbiased with respect to host galaxy type. Follow-up observations are performed with the Supernova Integral Field Spectrograph (SNIFS), a novel instrument installed on the University of Hawaii 2.2-meter telescope on Mauna Kea and commissioned in April 2004. By providing time series of flux-calibrated optical spectra taken every two to three nights for each supernova, the SNfactory data set will dramatically improve our understanding of the physics of SNe Ia and reduce the uncertainties in their use as cosmological standard candles. SNIFS observations have been conducted remotely from the United States and France since June 2004, with increasing emphasis on scripting and automation for greater efficiency. This poster reviews the current status of SNIFS and of the SNfactory project and presents its first results after the commissioning of SNIFS.

The Search:

The search for new type Ia supernovae (SNe Ia) is performed with data from the NEAT (JPL) asteroid search and QUEST (Yale) groups, using the Samuel Oschin 1.2-m telescope at Palomar. The QUEST has group installed a new 112 CCD camera with a 9 square degree field of view capable of both point-and-track and drift-scan imaging. The telescope is automated and can survey up to 1,000 square degrees of sky per night. Unlike directed-galaxy SN searches, this search is unbiased with respect to host galaxy luminosity.

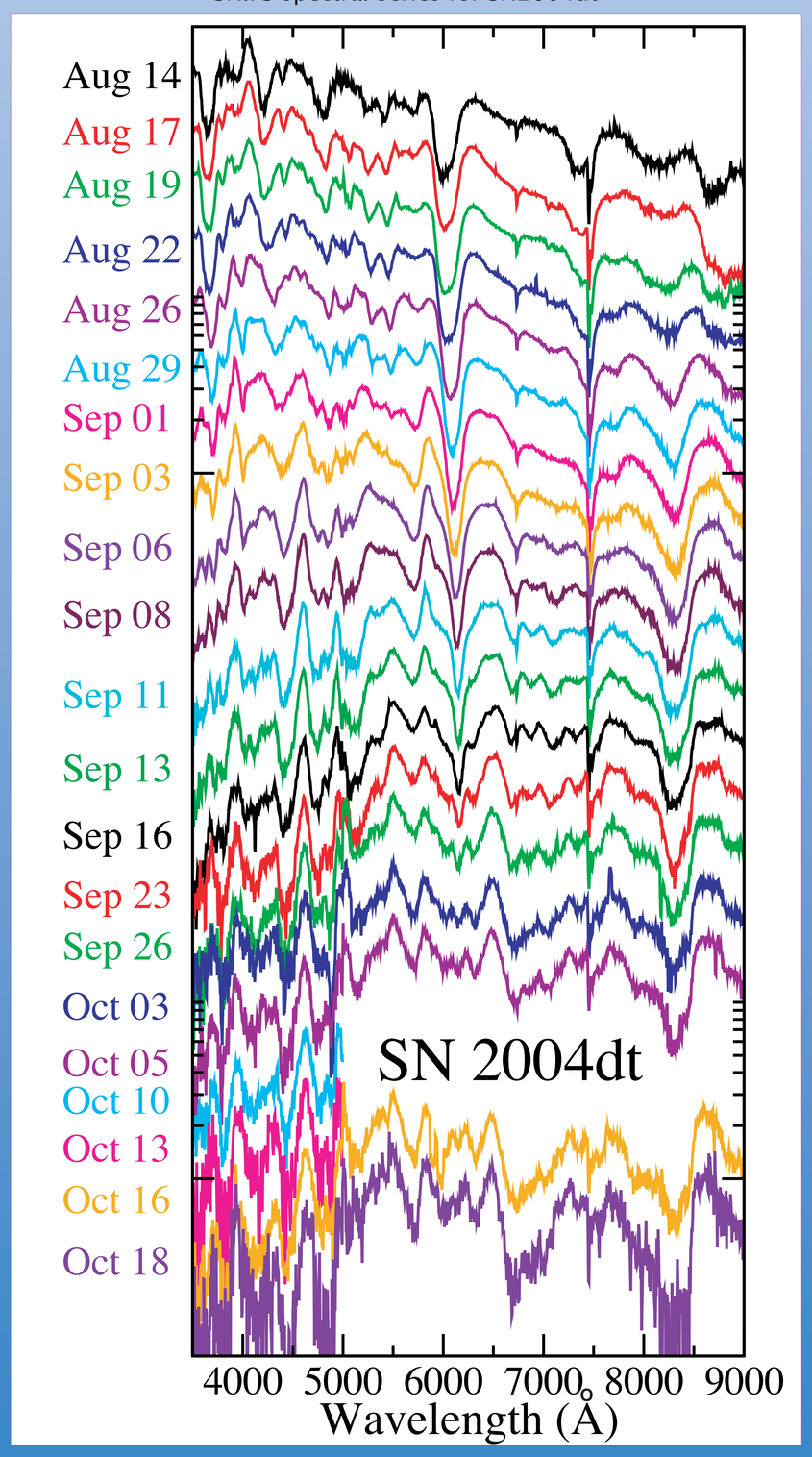




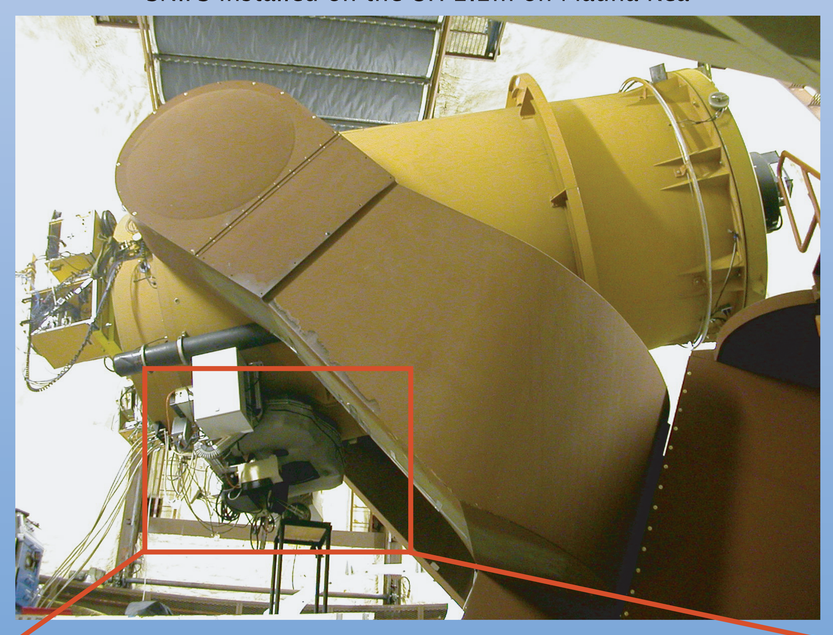
The SNfactory searches for SNe Ia in the redshift range of 0.03 to 0.10, distant enough to be in the smooth Hubble flow (and thus minimize uncertainties due to their peculiar velocities), yet close (and thus bright) enough to allow for screening spectra of all candidates and spectra every few days (10 to 15 spectra total) for each of ~100 confirmed SNe Ia per year. Our efficiency in recovering simulated SNe Ia at $z < 0.08$ is over 90%.

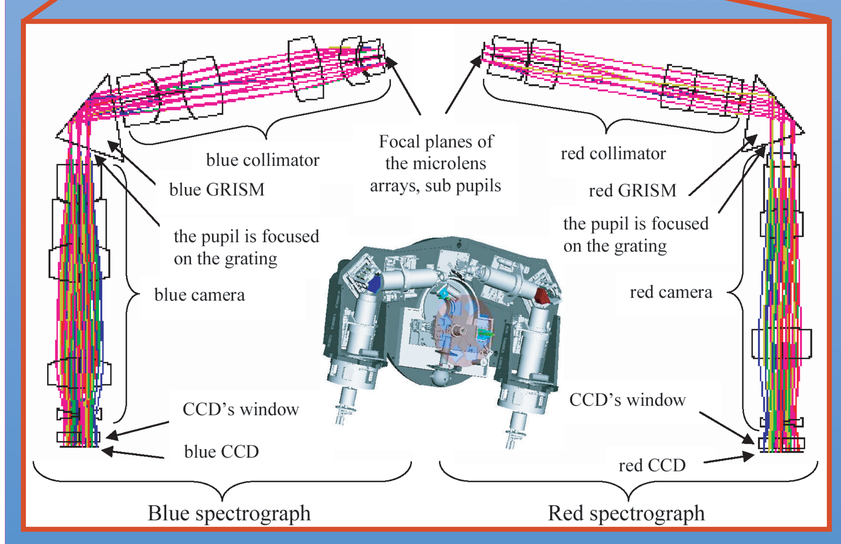
SNIFS BVz Image of SN2004dt

SNIFS spectral series for SN2004dt



SNIFS installed on the UH 2.2m on Mauna Kea





Spectrograph

Channel	Blue	Red
Coverage	3500-5500 Å	5500–10000 Å
Spectral Resolution	2.3 Å	3.3Å
Grism	300 l/mm ($\lambda_B = 4200$ Å)	300 l/mm ($\lambda_B = 6500$ Å)
Detector	Marconi 2k × 4k	E2V-DD 2k × 4k
Calibration	He/Hg/Cd + flat	Ne/Ar/Xe + flat

Integral Field Unit

Scale	0.4″/ lens
Field of View	6″× 6″

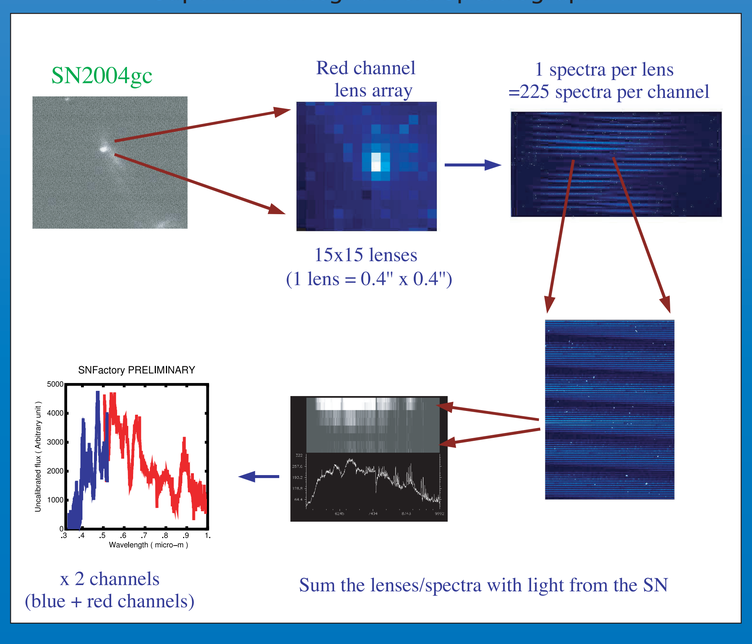
Guider/Focuser Camera (Fixed)

Scale	0.14″/pixel
Field of View	4.7′× 9.4′
Detector	E2V 2k × 4k
Filters	none

Auxiliary Camera

Scale	0.14″/pixel
Field of View	4.7′× 9.4′
Detector	E2V 2k × 4k
Filters	UBVRIZ + extinction monitor

SuperNova Integral Field Spectrograph



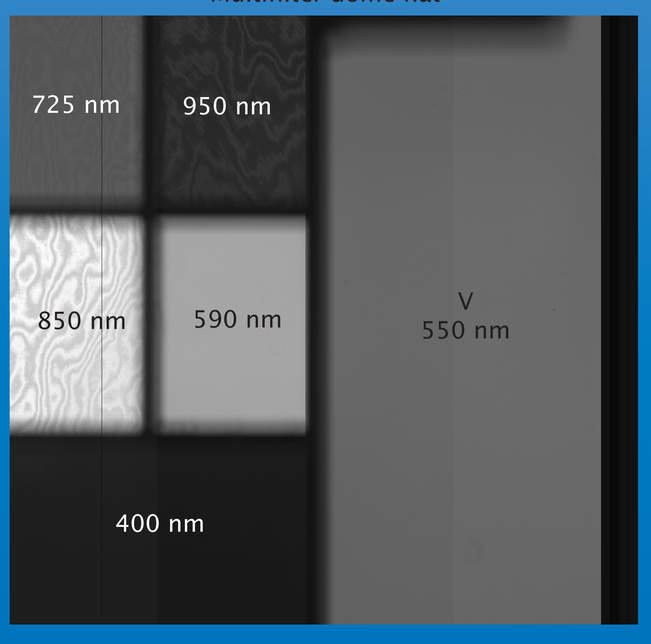
SNIFS:

In order to obtain spectrophotometric observations of ~300 SNe Ia, the SNfactory constructed the SuperNova Integral Field Spectrograph (SNIFS), which was installed on the UH 2.2-m telescope on Mauna Kea in April 2004. At present 20% of all observing time on the UH 2.2-m is devoted to observing supernovae with SNIFS. The instrument features a dual-channel optical spectrograph (left) and an imaging/guiding camera (right).

Each spectrographic channel exploits a 15x15 microlens array to image 225 spectra across the 6"x6" field of view.

During each spectroscopic exposure, the imaging camera makes multi-band photometric observations of stars in an adjacent field using custom-designed filters. By comparing the observed brightnesses of these stars to the brightnesses observed on a photometric night, the corresponding supernova spectrum can be corrected for atmospheric extinction even on non-photometric nights.

Multifilter dome flat



For more information on the SNfactory, contact Richard Scalzo (RAScalzo@lbl.gov) or Greg Aldering (GAldering@LBL.gov) or visit out webpage at http://snfactory.lbl.gov/